REMARKS

ON THE

GASEOUS OXYD

OF

AZOTE OR OF NITROGENE,

AND

ON THE EFFECTS IT PRODUCES WHEN

GENERATED IN THE STOMACH, INHALED INTO THE LUNGS, AND APPLIED TO THE SKIN:

BEING

AN ATTEMPT

TO ASCERTAIN THE TRUE NATURE OF

CONTAGION,

AND

TO EXPLAIN THEREUPON THE PHENOMENA OF

FEVER.

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PREFACE.

IT has a long time appeared to me highly probable, that contagion was an aëriform fluid, produced occaſionally, and exerciſing for a ſeaſon its deſtructive effects. Since my appointment to the Profeſſorſhip of Chemiſtry in the College of New-York, my mind has been particularly engaged in acquiring as full a knowledge as I could of the gaſſes. In the courſe of my experiments and inquiries, I have become ſatisfied my original conjecture was right; and I have to acknowledge the pneumatic philoſophy has led the way to an elucidation of this hitherto dark and intricate ſubject. The combination of the baſe of vital air *with the* radical of nitrous acid *forms a compound which, though little known, poſſeſſes very remarkable qualities. If*

the principles laid down in the following pages are true, a conſiderable number of intereſting deductions may be drawn from them, both in the theory and practice of phyſic, and in relation to health offices and the means to be adopted for guarding againſt infectious diſtempers. Under the perſuaſion, that the mode of conſidering this ſubject is novel, the performance is ſubmitted to the conſideration of the public. My fellow citizens, for whom it was written, will learn how much the preſervation of health is in their own power.

Plandome, Auguſt 20, 1795.

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ON THE

Gaſeous Oxyd of Azote, &c.

THIS is the air mentioned by Prieſtley (ii. Exp. & Obſ. 54, &c.) under the title of *Dephlogiſticated Nitrous Air*. He diſcovered it by expoſing nitrous gas to iron, whereby that aëriform fluid was transformed in about two months to a ſpecies of gas of a very remarkable kind, "which keeps up combuſtion naturally and "freely in a candle immerſed in it, but is at the "ſame time highly noxious to animals, and "deſtroys their life the moment they are put into it:" whereas it commonly happens, that animals can live tolerably well in air ſo vitiated by inflammation, that a candle will no longer burn in it.

He obtained this air too by applying heat to a diſſolution of iron in nitrous acid, after the production of nitrous gas was finiſhed; in a direct proceſs by the diſſolution of zinc and tin in nitrous acid; by expoſing nitrous gas to a mixture of iron filings and ſulphur moiſtened with water, and to hepar ſulphuris; and likewiſe by iron and ſolution of copper in the nitrous acid.

He found, that when phlogiſticated air (nitrogene or azotic gas) and dephlogiſticated nitrous air (gaſeous oxyd of nitrogene or azote) were mixed together, it was an eaſy matter to ſeparate them by means of water; for the latter, by reaſon of its readier miſcibility with water, will combine with that fluid in a very pure form, while the former will remain unabſorbed.

Prieſtley's ſpeculations concerning the conſtitution of this air are attended with all the difficulty which beſets the doctrine of phlogiſton; and its true compoſition ſeems not to have been detected until ſince he wrote.

In the ſecond number of the *Recherches Phyſico Chymiques*, publiſhed at Amſterdam, an account is given, which confirms the facts related by Prieſtley. For this gaſeous oxyd was obtained by expoſing nitrous gas for three days over water to the action of wetted iron filings; by the ſubtraction of part of the oxygene of nitrous gas; by the moiſtened ſulphures of potaſh and ſoda; by the muriate of tin; and by ammoniac with a bit of copper in it: it is related alſo, that ſolutions of iron and tin in extremely diluted nitric acid, afford this gaſeous oxyd, and that the nitrate of ammoniac heated after mixture with three times it quantity of ſand, gives toward the end of the operation a large quantity of it.

One of the moſt happy diſcoveries of modern ſcience is that of the *principle of acidity* or *oxygene* being capacitated to afford products poſſeſſing very different qualities, by combining in greater or leſs proportion with the ſame radical.

radical. Thus, for example, azotic or nitrogene gas conſtitutes $\frac{73}{100}$th parts of our atmoſphere. Simple nitrogene, the baſe of this gas, is capable of combining with the principle of acidity as well as the matter of heat (caloric) in four diſtinct proportions. Azote, in its higheſt degree of oxygenation, forms *nitric acid;* in its next, it conſtitutes *nitrous acid;* in a lower, *nitrous gas;* and in the fourth or loweſt degree it affords the compound, now more particularly under conſideration, *the gaſeous oxyd of azote, of nitrogene.* We hence know, with the utmoſt certainty, that oxygene, or the baſe of reſpirable air, which compoſes the remaining $\frac{27}{100}$th parts of the atmoſphere, is in many proceſſes blended with azote in various quantities.

In the gaſeous oxyd, produced by the union of theſe two atmoſpheric ingredients, the portion of the acidifying principle combined with its nitrogene baſe is too ſmall to manifeſt the ſmalleſt degree of acidity; not even ſo much as to have any effect wrought upon it by expoſure to liquid cauſtic alkali, nor muriated tin; and in its pure ſtate undergoes no ſhrinking, decompoſition, or change, by mixture with the atmoſpheric fluid, nitrous gas, or vital air.

The properties of this oxyd are ſo ſingular and extraordinary, that Prieſtley affirms, (ii. 55.) at the time of his firſt publication on the ſubject, *he ſhould not have heſitated to pronounce them impoſſible;* to wit, a power, at the ſame time, of ſupporting flame, and of extinguiſhing life. This ſurpriſing quality is however doubtleſs owing to the difference in the attractive force which

which its oxygene exerts for hydrogene in the one caſe, and for carbone in the other; for it is known, that by mixing the gaſeous oxyd of nitrogene with carbonated hydrogene gas, the carbone is precipitated from its ſolution. Hence it appears, that the attraction for charcoal is much weaker than for hydrogene, and that although carbone may be made to burn in the gaſeous oxyd, hydrogene is the ſubſtance for which it has the cloſeſt affinity. And we can now readily conceive how the hydrogene of the candle may, in an eſpecial manner, contribute, by attracting the principle of acidity from the gaſeous oxyd, to keep up the inflammation, wherein ſome part of the charcoal may likewiſe, though in a ſecondary way, be converted to carbonic gas. It may be underſtood too, wherefore it is not capable of ſuſtaining life. There are two important purpoſes anſwered by animal reſpiration; the one to furniſh oxygene to the phoſphoric, ſulphureous and carbonic matter of the blood; the other to carry off its ſurpluſage of charcoal by means of the lungs. Now the gaſeous oxyd has leſs action upon phoſphorus and ſulphur than it has upon charcoal. Hence it is a very natural concluſion, that in ordinary breathing, the gaſeous oxyd does not only not yield its principle of acidity to the blood in the pulmonic circulation, but at the ſame time does not ſufficiently attract carbone from the venous portion of it; whence it comes to paſs, that an animal inhaling an air, contributing to neither of theſe ſalubrious proceſſes, muſt ſpeedily die; its blood being both

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in a diſoxygenated and ſuper-carbonated ſtate; hydrogene alone being the ingredient in phlogiſtic operations which readily attracts its oxygen from the gaſeous oxyd.

The proportion of oxygene entering into gaſeous oxyd is $\frac{37}{100}$; the other 63 parts being nitrogene; whereas in nitrous gas, the oxygene conſtitutes 68 parts of the 100.

On reflecting upon theſe facts, it occurred to me this ſubject merited conſideration in ſeveral other points of view: As,

1. Since this remarkable aëriform product is afforded by a variety of artificial proceſſes, whether it is not generated likewiſe by a natural operation in the decay of organized bodies, containing both nitrogene and oxygene?

The hiſtory of nitre throws great light upon this query. That ſubſtance is known to conſiſt of nitrous acid joined to pot-aſh. It is uſually formed during the decay of animal and vegetable bodies, and by a ſpontaneous proceſs, is produced from their ruins. We are quite ſatisfied that azote and oxygene entered into the compoſition of thoſe bodies when alive, and have gone into new combinations on their diſengagement by death. One of theſe recent compounds muſt be nitrous acid, conſtituting by junction with a ſaline baſe, the nitrate of pot-aſh. Thus, the theory of the formation of ſalt-petre neceſſarily preſumes the generation of nitrous acid from two of the elements diſengaged from organic texture. And as azote, the radical of the acid, is eſpecially abundant in animal bodies, and as Lavoiſier (i. Traité elementaire

mentaire de Chimie, 155.) says, *favorise merveilleusement la putrefaction*, wonderfully promotes putrefaction, there is little difficulty in conceiving, both how in such circumstances it attracts the acidifying principle, and afterwards attaches itself to the alkali.

But further than this, the authority of Mr. Becker (Notes to Bergman's Elective Attractions, 327.) has been advanced in favour of the production of nitrous acid without the aid of the putrefactive fermentation at all. He found nitrous acid in the urine of cows, which had been eight days exposed to the sun. He mixed some of the soakings of a dunghill with a ley of burnt sheep's dung and chalk in powder. The mixture began to ferment on the following day, and on the fourth, the internal commotion having ceased, he found at the bottom of the phial regular chrystals of prismatic nitre. He ascribes the nitrous acid not to a process going on in the air, but brought about by the *excretions of animals*. On examining the earth of stables and cow-houses, he found its lixivium to yield prismatic nitre, while that of the dung would afford only small chrystals, which required an addition of nitre in order to be reduced to a prismatic form; and he declares he can attract salt-petre at pleasure, in the course of three days, from the earth of stables and cow-houses, by using for saturation well-purified pot-ashes.

In the production of salt-petre, the putrefied substance, if of the animal kind, affords little more than the nitrous acid. This was known

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to Boerhaave, who (i. Elementa Chemie, 44.) ſays, the nitrous quality of the earth is derived from the excrements of animals and their putrefied carcaſes, particularly ſuch as do not uſe ſea-ſalt, as birds, which, by the addition of the aſhes procured from the burning of plants and of quick-lime, forms ſalt-petre, &c.

This fact of the animal origin of the nitrous acid is confirmed by the teſtimony of Macquer, (iii. Dictionaire de Chimie, 18.) who declares, that in the putrefactive proceſs which affords nitrous acid, animal ſubſtances have a decided preference; ſo that, in order to make chryſtallizable ſalt-petre from ſubſtances purely animal, a quantity of the vegetable alkali muſt be added; while the ſalt-petre produced in the putrefaction of vegetables alone is *naturally* found to be furniſhed with that quantity of fixed alkali which is neceſſary to form good nitre.

To this may be added the authority of Fourcroi, (ii. Lecon Elementaires, &c. 842.) who ſpeaks of *acidity* as one of the early ſigns of animal putrefaction; and of the proper putrid exhalation as not to be confounded with carbonic acid, (fixed air) hydrogene gas, (inflammable air) which are at the ſame time let looſe, nor with the phoſphoric emanation which ſometimes glows on the ſurface of corrupting animal ſolids. When to all this it is ſubjoined, that on analizing the ſoil taken from the bottoms of graves where human bodies have putrefied, it has been found, though having no communication with the external air, to be highly charged with nitrous

trous acid, the animal origin of this acid is put entirely out of doubt.

We hence see the reason why the French chemists have advised the use of wood ashes to neutralize the redundant nitrous acid in their salt-petre works, and have even gone so far as to recommend foreign pot-ash as greatly preferable. On this subject, the valuable paper of Mr. Massey may be consulted in the Memoirs of the Manchester Society, where it is made to appear, that earths become impregnated with nitrous acid during the putrefaction of animal substances, but will not afford a crystal of nitre until the vegetable alkali is added.*

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* *It is a pity, that notwithstanding all these things, the French Academicians who framed the new Nomenclature, suffered themselves to retain the words* nitrous *acid*, nitrous *gas, &c. which seem to me to be very improper, and to be quite as subject to objection as the terms* azote *and* nitrogene, *for their radical. The mind becomes unhappily impressed with the notion of those products being derived from nitre, whereas the fact is, nitre derives its origin from this* animal acid. *Had I been a member of that committee of the academy, I should have proposed to derive the name of the radical from the Greek verb* σηπω, putrefacio; *to call it* σηπιον, putridum; *and have made the Nomenclature stand thus:*

1	2	3	4
Septon; instead of azote or nitrogene.	Septous gas; instead of azotic gas or nitrogene gas.	Gaseous oxyd of septon; instead of gaseous oxyd of azote or of nitrogene.	Septic gas; instead of nitrous gas.

In these several ways, we find nitrous acid afforded by the putrefaction of animals themselves, and by changes in their excretions. Now, nitrous acid, differing from the gaseous oxyd, barely in the degree of oxygenation, there is no difficulty in comprehending, that if there was in any instance a spontaneous formation of the former, there would, *a fortiori*, be a more easy and frequent production of the latter.

And here it happens, that the very thing which reason seeks for, nature affords. That particular gas, described by Mr. St. John (Preface to Method of Chemical Nomenclature, xi.) as produced at certain times during the putrefaction of human bodies in dissecting rooms, and as being a most active and dreadful poison, is, in all probability, the very aëriform product which is the subject of this memoir. That exhalation is not only incapable, in its concentrated condition, of sustaining life, but, like the gaseous oxyd, though it may be rendered less

 injurious

5	6	7
Septous acid; instead of nitrous acid.	Septic acid; instead of nitric acid.	Septate; septite, &c. &c.

and then, the original of the thing, being always suggested to the mind in the phraseology, truth would have found a more ready reception, and no such difficulty interposed as now besets us, prepossessed as we are with the notion, that the nitrous is a mineral *acid. For it should be remembered, that although it is obtained from nitre, a salt classed among the mineral substances, yet it was produced by animal putrefaction before the nitre was formed.*

injurious by dilution, does not however change its original virulence in the leaſt, by the preſence of the atmoſpherical fluids; and, like the gaſeous oxyd too, it is not remarkable for any fœtor or particular badneſs of ſmell; both of them differing entirely from the loathſome and nauſeous odour proceeding from dead bodies in a leſs dangerous ſtage of corruption.

The deleterious production, ſo particularly mentioned by Mr. Fourcroi, in his report on the removing the Cimiterié des Innocens at Paris, and now and then fatal to the grave-diggers, appears to be a gas of preciſely the ſame origin and qualities, and as in the former inſtance, is generated in the abdomen.

The gaſeous oxyd of nitrogene in theſe inſtances is always, as far as obſervation goes, of local origin, and ſeldom ſpreads very far in form ſufficiently condenſed to do miſchief. In large cities it is generally moſt abundant, by reaſon of the greater collection, along ſome of their ſtreets, ſewers, wharfs, docks, &c. of thoſe materials, which afford it, and, on account of the difficulty of ventilation, in certain lanes, yards and alleys, which allows the noxious vapour to ſettle there. In few inſtances that I have heard of, has it extended over a large tract of country; in the greater number of caſes, it invades but a limited part of a large city, and that only, when a temperature of the weather, between 75 and 85° of Farenheit's ſcale, favours the formation of the oxyd.

When applied to a living body, freſh and ſtrong on its firſt formation, it produces violent inflammation

inflammation and ulceration of the fingers or hand which come in contact with the body from which it proceeds; or drawn into the noſtrils, it excites alarming tumefaction, with heat and pain in the fauces and nares; or, if inſpired fully into the lungs, it brings on inſtant death.

2dly. If the firſt queſtion is ſatisfactorily decided in the affirmative, where large maſſes of animal and vegetable matter, in hot ſeaſons and confined places, undergo reſolution into their conſtituent parts, and form new combinations; then is it not preſumeable that gaſeous oxyd may be extricated from ſimilar materials by like cauſes, occaſionally, in the alimentary canal, or *primæ viæ* of human bodies while alive?

For the ſupport of animal life, it is neceſſary that ſupplies of food be, from time to time, received into the ſtomach. The ingredients of diet are of the animal and vegetable kinds, and conſequently contain all the materials, after their introduction into the body, that are proper to ſimilar ſubſtances out of the body. And were it not for the mixture with ſaliva, gaſtric liquor, pancreatic juice and gall, theſe alimentary matters would, from the operation of conſtant heat and moiſture, undergo putrefactive alterations in the ſtomach and ſmall inteſtines. By the operation of theſe animal fluids, the nutritious part of the aliment is diſſolved, and prepared for undergoing the proceſs of animalization. For it is to be remarked, that no living thing in the perfectly healthy ſtate exiſts in the animal ſtomach; the deſtruction of life, even in

oyſters, fiſhes, frogs, &c. ſwallowed entire, being a preparatory ſtep to their converſion into nutriment; and worms and other animals infeſting the guts, being enabled to live there only by poſſeſſing a conſtitution capable of counteracting the digeſtive proceſs.

Nobody has affirmed, that in the animal inteſtines, the fluids are endued with animation, any more than the aliment they contain. Our reaſoning then concerning the whole contents of the firſt paſſages, cannot be governed by the laws which regulate animated ſyſtems, but muſt proceed according to the rules governing the decompoſition of organic bodies in ſuch circumſtances. Chemical inveſtigation here meddles not with living nerves and fibres, whoſe functions are not to be interpreted by its aid, but limits itſelf to the watching into what new forms the inanimate parts of plants and animals are changed after introduction into the belly; a ſubject on which it is certainly competent to decide. It has been conſidered, that in ordinary caſes, the ſolution of food in the gaſtric fluid regularly takes place, and the diſcovery has been acknowledged to be one of the happieſt which phyſiology has to boaſt of. Beyond this, our inquiries are very little ſatisfactory; and the inteſtines, though ſo eſſential to health, and ſo frequently the ſeat of diſeaſe, have, in the midſt of much curious reſearch, been ſtrangely overlooked. If, in conſideration of their containing inanimate ſubſtances, prone to undergo the putrefactive proceſs, it can be ſhewn, that the cauſes uſually preventative

tive thereof are, during certain seasons, suspended or weakened, then it will be evident that changes may take place within the intestines, correspondent to those which go on without them, and that similar productions will flow from the one which are known to characterize the other.

Sydenham, (continual fever of the year 1661 and seq.) says, "he would give an emetic in the "beginning of that fever, that the sick might "be preserved from those dreadful symptoms "that *arise from the filth of those humours that* "*lurk in the stomach and neighbouring parts*, &c." and seems to have a good general idea of the noxious quality which the contents of the guts sometimes possess. In his account too of the pestilential fever and plague which raged in London in 1665 and 1666, he enumerates "violent vomitings, a pain about the region of "the heart, as if it were oppressed, and a burning fever," among the earliest symptoms.

Huxham, (Essay on Fevers, chap. viii.) describing the symptoms of the fevers which he terms putrid, malignant, and petechial, mentions, that together with "head-ach and giddi-"ness, *nausea* and *vomiting* are much more con-"siderable than in the slow nervous fever, *even* "*from the very beginning*."

In short, in the collected opinions of those physicians, whom Mr. Howard consulted on the plague, as prevailing in the south of Europe and in Asia, (Account of Lazarettos) dryness of the tongue, *vomiting*, *hiccough*, *nausea*, loss of strength and fever, are enumerated among the *first* symptoms.

Indeed, the obſervation of any phyſician of much practice, in complaints of theſe kinds, as well as in the yellow fever, bilious fever, &c. is ſufficient in ſatisfying him, without recurring to written authorities, that the diſeaſed ſtate of the alimentary canal is not only one of the firſt group of ſymptoms that attract his notice, but is of the moſt troubleſome and dangerous nature too.

It has been doubted what could be the cauſe of ſo much diſturbance in the ſtomach and bowels. The diſorders incident to theſe are peculiar to animals, and are derived from the neceſſity we are under, becauſe of our locomotive faculty, of carrying a quantity of manure conſtantly within us; on which account our organization in this particular differs exceedingly from the vegetable creation, who have their food brought them, but are under no need of taking the crude maſs within them. If vegetables then have no analogous ailments, it muſt be owing to their inhaling their chyle from their external ſurface, and the inconvenience experienced by animals, be referred to their taking into their bellies a good deal of matter beyond what is convertible to nouriſhment, and carrying the fœculent collection about with them. Our locomotive power is indeed a capital endowment; but the diſeaſes of the alimentary tube, with their endleſs train of ſymptoms and conſequences, are the immenſe price we pay for it. Upon this view of the comparative ſtructure of plants and animals, it would ſeem that we ſhould examine the kinds and qualities

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of food in the latter, in order to aſcertain the cauſes of thoſe complaints to which they are peculiarly ſubjected. And here it happens, we have a moſt ſtriking and inſtructive fact to guide us. Mr. Verdoni declares, "that the "Greek chriſtians in Smyrna, during the ſea- "ſon in Lent, when they *eat only vegetables*, are "very ſeldom attacked by the plague; while "*among thoſe who eat fleſh*, the contagion makes "great havock. Hence the beſt means of pre- "vention are to eat moderately, and *not at all* "*of animal food*, &c." And I believe a multitude of facts tending toward the ſame concluſion, could eaſily be collected.

The cauſe of plague, and conſequently of other analogous fevers, would ſeem to reſide then, in the animal part of the ingeſta; and ſo, according to the theory, it ought: for, from that ſource ſhould flow the azote, or baſe of the gaſeous oxyd, the cauſe of the moſt alarming and dangerous ſymptoms accompanying this claſs of diſtempers.

It is a fact worthy of particular regard, that the two caſes of contagion cauſed by the gaſeous oxyd, one produced from external cauſes, contaminating the air, and affecting the lungs and reſpiration, and the other ariſing from circumſtances exiſting within the body itſelf, and diſturbing the ſtomach and inteſtines, ſhould have been diſtinguiſhed by Hippocrates. In his book, *De flatibus*, he, with great ſagacity, notes the "*aër*" operating without the body, and the "*ſpiritus*" acting within, and both of them cauſing fevers; to the former he aſcribes *epide-*

mics,

mics, where, from a change in the qualities of the air, many perſons are incommoded, as in peſtis; to the latter, he attributes *ſporadics*, where, from bad diet, flatulencies proceed, creating diſturbance in the whole animal frame.

There are four facts concerning the alimentary maſs which impreſs the mind with the belief of the actual extrication of the gaſeous oxyd in the primæ viæ. Firſt, The production of a gas is manifeſted by tenſion, oppreſſion, and belching, as unequivocal ſigns denoting wind, diſtending the bowels. Secondly, On ſome occaſions, there is a vomiting of *black* matter, which conſiſts frequently of extravaſated blood; this tends to determine the gas to be of ſuch a ſort as to afford no oxygene to the blood, which therefore requires no floridity. Thirdly, The exiſtence of *green* ſtools, in certain ſtages of the diſeaſe, point with more certainty to this oxyd as their cauſe, particularly ſince it has been obſerved to tinge both water and glaſs of a remarkable green colour. And fourthly, There is no inſtance related of perſons afflicted primarily with this malady, except fleſh-eaters.

A ſource of poiſonous effluvia thus ſeems to exiſt in our own bodies, ſufficient to diſturb the animal machine exceſſively, and even to effect its deſtruction. There can hardly exiſt a doubt, that the great quantities of butcher's meat, poultry and fiſh which we conſume, are the materials which chiefly afford the gaſeous oxyd, and that in our choiceſt viands, we ſwallow down the principle of ſickneſs and decay. The fleſh of ſlaughtered animals, prone in hot weather

ther to enter upon an incipient putrefaction, may, in some cases, not meet with a sufficient corrective in the stomach, and pursuing its propensity there, may go on to rot and rot, and induce, by its mischievous productions, the most calamitous consequences.

It has been long ago doubted, by considerate and humane persons, whether man was justifiable in preying upon his fellow animals. The authority of revelation, added to the make of his teeth, and the conclusions of reason, have decided in favour of his right. But how far this indulgence, or luxury, for animal food can scarcely be called a necessary of life, may be gratified, is left wholly undetermined. Our own experience alone, of the wholesome or pernicious effects resulting from its use, must guide us. Judging by this, there appears a physical certainty, that we devour more of it than does us good; nay, that in the enormous destruction of animal matter, raised in such abundance for our riot and gluttony, some of the most serious of bodily evils are generated, and these particularly in cities, camps and ships, badly regulated. The causes of such distempers are deeply founded in our state of society and way of life, and as long as we gorge ourselves with animal food, and dwell among its putrefactive recrements, the poisonous gaseous oxyd of azote proceeding therefrom, must be expected to disturb both our respiratory and digestive functions, and be followed by scenes of distress and woe.

3dly. Provided, the oxyd should be produced during the disorganization of the food, &c. in the

the alimentary canal; what changes will it bring about in the chylopoetic viſcera, and what ſymptoms excite in the conſtitution at large, particularly in thoſe who at the ſame time inhale more or leſs of it into the lungs?

No perſon acquainted with the mode in which the animal body acquires its heat in the lungs, need be informed that, in a caſe where the gaſeous oxyd has, in a dilute form, been breathed, and from the ſituation and circumſtances of the patient continues every moment to enter the trachea, the ſymptoms will be very different from thoſe of a perſon whoſe reſpiration is free from contagion, but has the noxious gas in his bowels merely. It is therefore to be carefully conſidered, that according to the nature and function of the organ on which the gaſeous oxyd exerciſes its virulence, will there be a variety in the morbid ſymptoms, though produced by the ſame cauſe. If, for inſtance, the ſtomach and the inteſtines are the ſeat of the gaſeous reſidence, inflammatory ſymptoms of thoſe parts, with tenſion of the præcordia, dryneſs and redneſs of the fauces, great heat and high pulſe may be expected to ſupervene;—whereas, if the lungs are pervaded by it, the heat will be moderate, the countenance pale, purple, or yellowiſh, the pulſe ſlow, and the firſt paſſages more quiet: while the moſt violent diſeaſe muſt enſue, when both the lungs and inteſtines are expoſed to its virulence.

1. Let its effects upon the ſtomach and bowels be attended to.

Coſtiveneſs is favourable to the production of

this

this gaſeous oxyd, by retaining the fœces an inordinate length of time, and preventing the ready eſcape of the flatus. Accordingly, it is related, that in the bilious yellow fever of Philadelphia, which prevailed in 1793, (Ruſh's Account, &c. 52.) "the bowels were generally "coſtive, and in ſome patients as obſtinately ſo "as in the dry gripes; and flatulency was an "almoſt univerſal ſymptom in every ſtage of "the diſorder."

From its qualities, as mentioned before, we are at no loſs to explain the painful burning which ſometimes occurred before any vomiting took place, and the gaſtrodynia which at times uſhered in the diſeaſe. Nor, when we conſider the irritated or inflamed condition of the parts, can we be at a loſs to underſtand wherefore it ſeldom appeared without nauſea and vomiting, and why that vomiting was ſometimes ſo long continued, violent and convulſive.

The inflamed ſtate of the ſtomach and duodenum, and other parts of the inteſtinal tube, in all caſes of diſſection after death, and the black, gangrenous and mortified ſpots found thereabout in numerous inſtances, are juſt ſuch as might be expected from the operation of a gas ſo deleterious as the azotic oxyd, which in ſome caſes of high malignancy may be imagined to acquire by union with a larger portion of oxygene than common, an uncommon degree of activity, or *acrimony* as it is called; in its effects, reſembling in every particular that condition induced by the oxyd of arſenic.*

The

* *It is remarkable what an analogy there is be-*

The coffee-coloured, grumous and dark matters ejected from the ſtomach, are probably in a great meaſure derived from the ſanguineous fluid, blackened by contact with the gas, and effuſed from the veſſels ruptured by its eroſion or cauſticity. Some part of them may conſiſt of bile vitiated by the ſame cauſe, and of putrid ichor proceeding from the gangrenous ſpots.

Excoriations of the rectum and external termination of it, correſpond to the inflamed ſtate of the ſuperior portions of the inteſtinal canal, and

tween this oxyd of azote and metallic oxyds. Azote, as well as the metals, in its pure ſtate has little or no chemical operation upon the body: as ſoon, however, as they become oxydated, they acquire activity; and that this activity is proportioned to the quantity of oxygene they abſorb, is ſufficiently evinced by the preparations of antimony, arſenic and quickſilver. There is another trait of character in which azote reſembles arſenic and ſome other metals, which is, that they are both acidifiable baſes: as by increaſing the quantity of oxygene, you change the oxyd of the metal to an acid, poſſeſſing powers greatly ſuperior to what it poſſeſſed before, ſo, by giving the oxyd of the gas a larger doſe of the acidifying principle, you increaſe its activity to an extreme degree. There is thus a very ſtrong chemical analogy between the oxyd of azote, and white arſenic. Perhaps azote is a metal. Quickſilver is a metal, maintaining fluidity *under the common circumſtances of terreſtrial heat and atmoſpherical preſſure. May not azote be a metal exiſting in the ſame circumſtances of warmth and weight in a* vaporific *form?*

and are fairly aſcribable to the ſame cauſe; as is alſo the hiccuping.

In a word, the pain in the ſides, and in the regions of the ſtomach, liver, and bowels, with their hotneſs and ſpaſms, and with the conſequent diſtreſs both of body and mind, all indicate the locality of this malady, as well as point to the nature and cauſe of it.

There is one caſe which may be imagined to happen, in which the ſtomach and bowels are diſturbed by the gaſeous oxyd ſwallowed with the ſpittle and the food. Where the oxyd is abundant, it can eaſily be underſtood from its diſpoſition to unite with water, that ſome part of it may attach itſelf to the fluids of the mouth, and be ſwallowed; as alſo forming a connection with the alimentary maſs in the act of chewing, may, together with it, deſcend into the ſtomach; and thus, in either caſe, produce its harmful effects.

2. Its operation upon the lungs ſhall be next inquired into.

If a full inſpiration of the gaſeous oxyd be made, there will be a ſudden extinction of life; and this accordingly accounts for the fact related by Ruſſel, (Hiſtory of Aleppo, p. 232.) and confirmed by other obſervers, of many perſons falling down dead ſuddenly, when ſtruck with the contagion of the plague.

If a quantity of the ſame fluid be mingled in ſuch proportion in the atmoſphere, as by its dilute ſtate to produce neither immediate death, nor catarrhal affections; then the ſlow and undermining effect of it, by conſtant breathing, will

be manifeſted, firſt in the ſighing, anxiety, toſſing of the body; afterwards by languor, faintiſhneſs, coma; and afterwards by the ſleep-like and gentle approach of death.

An inhalation of a more condenſed or concentrated oxyd will account for the pulmonic ſymptoms ſometimes occurring, give riſe to pain and convulſions, and lead to an explanation why, after running a certain length, they ſhould ſuddenly end in effuſions of blood or other fluids to ſtop the reſpiration entirely.

I am ſatisfied, from experiments repeatedly made upon myſelf and others, that the heat of the body and beat of the heart and arteries are, to a certain degree, under the government of the will. This depends upon their connection with the reſpiratory organs. If, while all the other voluntary muſcles are at reſt, breathing be quickened by an effort of the will, the action of the heart and arteries will be increaſed, and ſo will the heat of the body; if, on the other hand, a perſon ſitting as quiet as poſſible in a chair, inſpires the ſmalleſt poſſible portion of air that he can, without bringing on anxiety, and continues to do ſo for ſome time, a thermometer placed in the arm-pit will fall ſeveral degrees, and the pulſations of the heart and arteries be exceedingly diminiſhed in frequency and force. I mention theſe experiments to ſhow how intimate the connection between reſpiration and the circulation of the blood is in the moſt healthy ſtate of the body, and how the latter is governed by the former. The heat of the body is nearly, other things being equal, in proportion

tion to the oxygene gas decompounded in the lungs, and ſo alſo is the force of circulation from the ſtimulant quality imparted to the blood. If the air inſpired be mixed with a large quantity of non-reſpirable air, then, though a full inhalation be made, there will be but a ſmall portion of vital air decompounded, and, as in the caſe of voluntary diminution of the breathing, the heat muſt be leſſened, and the contractions of the heart be more ſlow and feeble. It can eaſily be underſtood then, wherefore in ſome caſes there ſhould be weakneſs of pulſe; in others, no uncommon quickneſs or frequency; in others again, ſuch lowneſs that it can be hardly felt. We hence are enabled to underſtand why the pulſe ſometimes intermits, and to account for that remarkable ſlowneſs, which, when conſidered in this point of view, indicates extremeſt danger; while, according to the ordinary way of judging, it has been conſidered as denoting that there was no fever: and the juſtneſs of this interpretation is confirmed by obſerving, on diſſection, the blood in the heart reſembling, in its qualities, the blood of perſons that have been hanged. The coolneſs of the ſkin and the coldneſs of the limbs are in this manner very naturally accounted for.

In certain caſes of high malignity, the bodies of patients dead of fever cauſed by this gaſeous oxyd, have been all over disfigured with purple ſpots, and have even ſometimes aſſumed a blackiſh hue. Yea, even during life, vibices and blackneſs are known to make their appearance, and when they do, to be attended with cold-

neſs prevailing in the livid parts a day or two before death. Theſe appearances are entirely explicable upon the idea, that the lungs are filled with a ſpecies of air, not capable of oxygenating the blood, carrying away its carbone, and imparting heat to the body. The caſe deſcribed by Huxham, in pages 98 and 99, is a very inſtructive one, and illuſtrates this doctrine in a forcible manner; as does the caſe deſcribed by Sandifort. (Obſ. Anatom. Pathol. 11.)

From a review and conſideration of the hiſtory of ſuch caſes, it would appear there was a *ſcorbutic habit* of body induced, and that the hæmorrhagies, debility, and proſtration of ſtrength, as well as the darkened colour of the blood, and the want of coheſion in the ſolids, might be all accounted for upon the ſame principle in fever as in ſcurvy.

It very ſoon occurred to me, if my idea was juſt, that the gaſeous oxyd ought, when in a concentrated form, and approaching the ſtate of an acid, to manifeſt itſelf by corroding metallic ſubſtances. On inquiry, I found facts of that kind on record; for Van Swieten relates, "that "in the plague of Oczakow, the *ſilver* hilt of a "ſword, which all the time of the plague hung "up in a tent, was changed *quite black:* and "the inſtruments which the ſurgeons made uſe "of were turned as *black* and *livid* as if they had "been dipped in *aqua fortis*," (nitrous acid.) (Comment. in Aphor. Boerhaav. § 1407.)

Upon diſcovering this, I became convinced, that if my conjecture was right, a ſubſtance ſo active as the gaſeous oxyd ought, when applied to

to the ſkin of well perſons, to excite diſorder there, and this I found to be true: for Van Helmont (Tumulus Peſtis, p. 853.) ſaw a man, "who, upon touching ſome papers infected by "the plague, felt inſtantly a pain like the prick "of a needle; a peſtilential carbuncle made its "appearance ſoon after on his fore finger, and "he died in two days." A man who ſtirred up with his foot the ſtraw whereon the bed of a perſon ſick of the plague had been laid—"a "little while after he felt an acute pain in the "lower part of his leg, juſt above the foot, as if "the part had been ſcalded with boiling water; "the next day the epidemis or ſcarf-ſkin was "elevated into a large bliſter, upon breaking "which, a quantity of blackiſh liquor run out, "and underneath, a latent peſtilential carbuncle "was diſcovered, which could hardly be cured "in a fortnight." (Van Swieten, § 1409.)

There was another inference from my principle upon which I laid ſo much ſtreſs, that if it had not turned out according to my prediction, I ſhould have given up the whole matter as viſionary. This was the effect that air of the kind I had in contemplation ſhould have upon brute animals of the domeſtic kind. Thus *Sorbait* of Vienna (quoted by the laſt mentioned author) ſays, that during the plague, "*larks*, ſo numerous in Auſtria during the au-"tumn, were wholly wanting, ſo that not a "ſingle one could be met with; and *tame birds* "*kept in cages all died.*" Homer mentions the death of *dogs* and *mules* as the forerunner of the peſtilence in the Grecian camp before Troy.

(Iliad i. 69.) The pernicious and deadly effects of the atmosphere during the plague at Athens, in the second year of the Peloponnesian war, upon birds and beasts, and particularly on dogs, is mentioned by Thucidydes* (B. ii.) Boccace, in

* *The disputes concerning Epidamnus and Corcyra had for some time agitated the governments of Corinth and Athens. These dissentions, founded chiefly in a jealousy of the growing and encroaching power of the people of Attica, furnished sufficient pretexts for most of the states of the great Peloponnesus, to join in a confederate war against them. In the 431st year before Christ, the war began between the Peloponnesians and Athenians, and their confederates on both sides. That more vigorous preparation might be made for war, Pericles advised the Atticans to move from their country residences to their chief town Athens. His advice was followed. They sent away their flocks and labouring cattle into Eubæa and the adjacent islands, tore down their houses, and with their wives, children and furniture, sorrowfully moved from the open country, where they had been accustomed to live, to their metropolis. Great inconveniences were now experienced by them, especially since that, after repairing the waste committed by the invasion of Xerxes, the inhabitants had established themselves in a most comfortable way of living. After moving, they were obliged to adopt a new mode of life: few had houses ready for their reception: some sheltered themselves with their friends and relations: the greater part were forced to settle in the less frequented quarters of the city, in the buildings sacred to the gods and heroes; and many were even obliged to lodge*

in his account of the plague at Florence, " saw " with his own eyes, *two hogs* that had rolled " about with their snouts, and gnawed some " pieces of bread which had been thrown into " the street from a poor man's house who had " died of the plague, instantly seized with con- " vulsions, and died within an hour after." In *dogs* and *cats* the symptoms of plague have actually been known to appear, shewing themselves in the form of buboes, &c. The *cats* of Philadelphia died in 1793, and it is highly probable

themselves within the turrets of the walls, or wherever they could find a vacant corner. In short, there was a greater number of people than the city could contain, and after the Pelasgic *was occupied, the* Long-walls *and great part of the* Piræus *were portioned out to them for* little *dwellings. Thus pent up, the Athenians continued accumulating filth and every kind of noxious matter among them during the winter and until the ensuing summer, when, on the operation of heat, the gases were volatalized that brought on the memorable sickness, which has been called the* plague of Athens. *The attempt of* THUCIDYDES, *to trace it back to* Lybia, Egypt *and* Æthiopia, *is wholly unsatisfactory, and just as groundless as our own endeavours at present to prove* yellow fever *always imported from the West-Indies or some other foreign place. The causes of the plague at Athens, which was, in fact, only a very bad yellow fever, existed among themselves, just as they do among the New-Yorkers and Philadelphians now-a-days. A truth so plain and so important as this is, ought to be candidly received by every citizen of the United States.*

bable their deaths are to be in part aſcribed to the gas they breathed.

Again, if the idea I entertained was well founded, the gaſeous oxyd ought, when very concentrated, to ſhew its capability to ſupport flame. The two following facts, though not related with ſufficient accuracy or diſtinctneſs, are however caſes in point, and as far as they go, illuſtrate and confirm the doctrine in a forceable manner. The firſt is, "that a light-"ed candle being held near dying perſons, a "very *livid* vapour was ſeen to iſſue from their "mouths." The other, the relator ſays, he frequently obſerved in the form of a *blue* ſmoke, as it were, in the rooms where the infected lay. (Van Swieten, § 1407.) Now, when theſe facts are compared with what Prieſtley deſcribes of a candle burning in the gaſeous oxyd with an enlarged flame, by another flame (extending every where to an equal diſtance from that of the candle, and often plainly diſtinguiſhable from it) adhering to it, and in ſome of his experiments burning *blue*, there appears to be conſiderable ſimilarity in the caſes.

Moreover, knowing that under an atmoſpherical preſſure, which ſupports the quickſilver in the barometer at 29.84 inches, and in a temperature of 54.5 of Farenheit's ſcale, a cubit foot of azotic gas weighed one ounce thirty grains and one half; and of oxygenous gas, one ounce one dram and fifty-one grains; it was preſumable that a combination of the two, that is, thirty-ſeven parts of oxygene united with ſixty-three of azote, would form a fluid of near-

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ly the ſame weight with atmoſpherical air, or rather heavier, and the probability of this would increaſe, by conſidering that a cubic foot of nitrous gas, which contains only thirty-one parts more of oxygene than the gaſeous oxyd does, weighs one ounce two drams and thirty-nine grains. An inference from this is, that perſons who reſide in low ſituations, where the gaſeous oxyd is generated, or patients who lie near the floors of infected chambers, ought to ſuffer more than others, by reaſon of their breathing an atmoſphere more loaded with non-reſpirable vapour, tending downward on account of its weight. This inference from the principle is alſo conformable to fact, ſince it is known both in New-York and Philadelphia, the lower parts of the city have been moſt ſeverely afflicted, and that phyſicians, friends, nurſes, &c. who walk erect in the chambers of the decumbent ſick, eſcape danger, and breathe a tolerably pure air; while the unhappy patient, laying near the floor, toward which the heavier oxyd ſettles, inhales deadly gas at every inſpiration.

Again, it was clear to me from the little diſpoſition the gaſeous oxyd poſſeſſes to combine with other bodies, and, from its conſiderable weight, that it might be tranſported from place to place, in tight boxes or packages of goods, &c. and that, on opening theſe, and taking out their contents, the unchanged gas might be inſpired into the lungs, or inſinuate itſelf into the ſtomachs of ſuch perſons as ſhould be expoſed to it. This inference from the principle is alſo conformable to fact; for upon it depend the inſtantaneous

ſtantaneous deaths in ſome caſes; tranſported infection in others; and fevers kindled up in others, from the ſubtil matter exhaling from ſuch fomes.

Beſides, if, from the heavineſs of the oxyd, it always has a tendency to the lower parts, then ſhips, through whoſe ſides it cannot leak out by reaſon of their tightneſs, ſhould be very apt to accumulate it; and this too correſponds with the fact; ſea-veſſels being among the chief agents in its production and diffuſion, the receptacles of its collected virulence, and the ſeats of its moſt deſtructive ravages. Cellars are noxious for the ſame reaſon.

It muſt be obvious, that the ſymptoms of theſe febrile diſeaſes, excited by the gaſeous oxyd, are diviſible into two claſſes. Sporadic caſes may occur, in which, from its production within the body, the ſtomach and bowels may chiefly labour, and in theſe will the ſymptoms firſt enumerated prevail, attended with high excitement of the ſyſtem. Endemic ſickneſs may generally be expected, when, from an extrication of the gas in large quantity from ſome abundant ſource without the body, the contagion operates upon the lungs, and produces the ſecond claſs of ſymptoms, and in theſe will the pulſe be ſlow, and the heat moderate. The worſt caſes that can occur will be thoſe, where, both from external and internal cauſes, the ſtomach, and lungs, and ſkin, are attacked at once, and afford a mingled aſſemblage of ſymptoms.

There has been much diſpute about the production of contagion, whether from animal or vegetable

vegetable matter. The controverſy ſeems to me to be a trifling one. It is underſtood from analyſis, that the bodies both of plants and animals are compoſed of the ſame elements or principles, vaying in their proportions, ſtructure, &c. It is known for inſtance, that oxygene, which conſtitutes $\frac{37}{100}$th parts of the azotic oxyd, is very plentiful in moſt vegetable ſubſtances, and that ſome of them alſo contain a portion of azote, the ingredient forming the other $\frac{63}{100}$th parts. In ſuch caſes there can be no queſtion, that the oxyd might be produced during their decompoſition. It is likewiſe known, that animals contain a very great proportion of azote, and moſtly a moderate quantity of oxygene. There can be hardly a queſtion then, that the oxyd might be generated from decaying ſubſtances of this ſort. But as the one ſubſtance is highly charged with oxygene, and the other with azote, the mixture of the two ſeems moſt likely to afford the greateſt amount of oxyd, and this, I believe, is agreeable to fact. Pure animal matter will therefore perhaps be leſs likely to afford this oxyd than a mixture of it with vegetable. This explains why the ſtomachs of living perſons, containing commonly a mixture of the two kinds of food, and the abdomen of dead bodies, are ſo prone to the production of it; and why ſlaughter-houſes, tan-vats, currying-houſes, works for making glue and Pruſſian blue, the horner's buſineſs, oil ſhops, and manufactories of ſoap and candles, are not remarkable for generating contagion. There is very little aceſcent vegetable matter employ-

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ed there, and consequently the gaseous oxyd is sparingly formed. On the other hand, in vinegar cellars, wine presses, cyder mills, and other places where much unmixed vegetable matter of the oxygenous kind is accumulated, no inconvenience arises, as there is little azote to join in producing the oxyd. I see, however, no improbability in the idea, that independent of animal and vegetable matter at all, there may exist in nature some mode of combining oxygenous and azotic airs. But I know of no such process at present.

This inquiry has brought contagion home to our doors, and traced it to its seat within our bodies. Henceforth much of the labour employed in tracing the origin of fevers in foreign places, and their introduction in ships to our own ports, may be considered as superfluous.

Causes enough exist among ourselves, at certain times, to engender the most noxious vapours. The study of the production, and diffusion of these from domestic and internal sources, should most assiduously engage our attention. In doing this, we shall be employed in earnest, in counteracting as well as detecting this wide-spreading and terrible evil.

On this head I shall first speak of prevention, as it respects the stomach and intestines.

According to the theory delivered, the persons who live on vegetable food, or keep a lax belly, ought to have no disorder, or a very slight one. This conclusion is confirmed by facts in abundance. The advice given by the Arabian physicians to prevent the plague, enjoins

joins the repeated uſe of acid fruits, as pomgranates, Seville oranges, lemons, tart apples, &c. but above all wine-vinegar in ſmall quantities, &c. (Mead on the Plague, chap. ii.) Doctor Wade has eſtabliſhed the efficacy of a vegetable diet, (Ruſh on Yellow Fever, 334.) and of water as a drink, as the beſt means of preventing the yellow fever in a hot climate. Mr. Howard has borne teſtimony of the benefit of low diet as a preventative of the plague; and it is reported, that during the famous plague deſcribed by Thucidydes at Athens, Socrates the philoſopher preſerved his life by means of ſlender diet, as did Juſtinian at Conſtantinople in a ſimilar caſe, by his abſtinent way of living. The avoiding of animal food, adhering to a low diet, and taking laxatives, was doubtleſs one of the means of preſerving the life of Dr. Ruſh, during the late calamity in Philadelphia; and what may ſerve as a hoſt of facts, in a word, it is related by Bontius, that the plague has never yet ſhewn itſelf among the natives (rice eaters) of the Eaſt-Indies. Speaking of China, Dr. Mead ſays, "We have no inſtance of the plague "that was originally bred in that country."

Here then, we have evidence of ſuch an extenſive and concluſive kind, as to ſatisfy even the ſceptical mind concerning the eaſe and poſſibility of prevention. By avoiding animal food, azote is kept out of the ſtomach, the deſtructive gaſeous oxyd is not formed, nor are the inflammatory torments of the bowels felt. By keeping an open belly, the plan of ſecuring the health will be promoted, and no detention

of feculent matter give rise to flatulency and oppression. I doubt whether the metallic rod will more securely guard us from lightning, than vegetable food preserve us from pestilence.

As to the second head of prevention, as it regards the production of the gaseous oxyd in quantity sufficient to contaminate the air and injure the thoracic viscera, it forms so interesting a branch of general police, that it is needless to remark any further upon it than to say, while puddles of putrid nastiness, and piles of reeking dung are incessantly exhaling their poisonous steams, that magistracy consults very imperfectly the public health, which neglects the removal of such common nuisances. The city, as well as the individual citizen, wants a cathartic now and then; and by this plan, and by changing animal for vegetable food in the summer time, a world of sickness and mortality might be prevented.

In the case of gas already produced, and pervading the rooms of a house, or the houses of a neighbourhood, as it is formed by a chemical process, it may be very rationally demanded, whether, by some chemical operation, the gaseous oxyd may not be decompounded? It has been already stated in the history of the substance, that it resisted decomposition by sulphur, phosphorus and caustic alkali entirely; was but feebly attracted by charcoal; and that hydrogene was the only substance as yet known, having a powerful affinity to it. In what form this can be applied so as to separate the oxygene from the oxyd, and leave the naked azotic gas in the

the poſſeſſion of its ordinary harmleſs qualities, is a field for curious and uſeful inquiry.

Long ago has it been remarked, that our vices were the parents of our misfortunes. Never perhaps was ſentiment more ſorrowfully verified than in the preſent inſtance. Our luxury and feſtivity doom the inhabitants of air, earth and water to death; and it ſeems as if, in revenge for our cruelty, this tormenting ſpirit had ariſen from their graves to plague us.

HITHERTO we have been ignorant of the preciſe natnre of contagion; but ſince we are become acquainted with its production and compoſition, it is very much in the power of individuals to guard themſelves againſt it, and for magiſtrates to protect cities from its ravages. To what extent the principle now ſtarted may be carried in explaining other diſeaſes, is not eaſy to imagine. One can hardly ſuppreſs the conjecture, that the ſame poiſon which in a coſtive habit of body cauſes inflammation of the ſtomach and dreadful fevers, will, in a lax habit, occaſion cholera or diarrhœa, or in caſe the large inteſtines be obſtructed, terminate in dyſentery. How far it may, when operating on the lungs, concur in producing influenza and ſcarlatina, is an intereſting queſtion. And this is particularly worthy of our notice, from the reaſon and analogy of the thing, independent of the very remarkable and impreſſive fact related by the elegant and judicious author of the account of the yellow fever in Philadelphia in

1793,

1793, who tells us, (p. 6.) that cholera, remitting fevers, dyſentery, influenza and ſcarlatina were the immediate forerunners of the diſorder he deſcribes; and that, "in the courſe "of a few weeks, (p. 89.) they all diſappeared "or appeared with ſymptoms of the yellow fe"ver; ſo that after the firſt week in September "it was the ſolitary epidemic of the city." The caſe of the girl immediately following this quotation proves the propoſition I am contending for to a demonſtration. There is reaſonable ſubject of inquiry too, how far phthiſis in hot climates, and ſcrophula, may be derived from a like ſource.

The connection of this fever with other complaints is ſtrikingly exemplified in the following narrative: (Anſon's voyage, fol. p. 131.) But, (ſpeaking of ſcurvy) ſays Mr. Walter, "it "is not eaſy to complete the long roll of the "various concomitants of this diſeaſe; for it "often produced putrid fevers, pleuriſies, the "jaundice, and violent rheumatic pains, and "ſometimes it occaſioned an obſtinate coſ"tiveneſs, which was generally attended with "a difficulty of breathing, &c. &c. At other "times, the whole body, but more eſpecially "the legs were ſubject to ulcers of the worſt "kind, &c. &c." The evidence of analogy, too, ſtrongly favours the opinion, that other contagions and poiſons may conſiſt of the ſame materials, varying but in their proportions, or in ſome unimportant circumſtance, and that the virus of ſyphilis, ſmall-pox and meaſles, and of the ſpider, rattle-ſnake, and other venomous creatures, as being all of animal production,

duction, may consist in the main of azote and oxygene, combined perhaps with some other ingredient: and there is high probability that marsh miasmata will be found little else than a similar compound. The ichor of cancer and other corroding ulcers is very probably pretty much the same thing. The disease of rabid animals, and the dread of water and other miserable symptoms consequent upon their bites, may very probably receive some light from this source; and so perhaps may sibbens, yaws, and leprosy.

We have considered already what varied symptoms may be caused by the same matter operating upon different parts of the animal frame. In all probability much of the difference observable in the operation of different poisons, arise from the sensibility, irritability, structure and function of the part to which it is applied. This idea at least seems to be countenanced, by what we observe in the syphilitic virus, which, when applied to a secreting surface, causes gonorrhœa; to a dry one, chancre; to a glandular surface, bubo, &c. who knows but a similar exciting cause may, by operating upon the constituion, in one way, produce continued, in another remittent, and in a third, intermittent fevers, which in reality differ from each other less in their causes than in the particular part of the body to which this cause is applied? The difference of the several fevers brought on by this gaseous oxyd being chiefly connected with the viscus or function injured by its action, it is to be understood, that if the liver is invaded, this may induce, according to circumstances,

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an impeded ſecretion of bile, and then there will be a fever without yellowneſs, or an obſtruction of the gall-ducts, when, from an abſorption from the ſecreted fluid, there will be yellowneſs tinging the eyes or ſkin, or a vitiated ſecretion, appearing in the form of a green or brown matter vomited up. In like manner, when the lymphatic ſyſtem is the ſeat of its action, it may cauſe buboes in the glands; or when the ſkin is beſet by it, carbuncles, ſores, and miliary and petechial eruptions may break out. So likewiſe in the mouth and fauces, aphthous ulcers, and eryſipelatous inflammation, a ſpreading perhaps of the original malady in the ſtomach, may all derive their origin from the ſame cauſe.

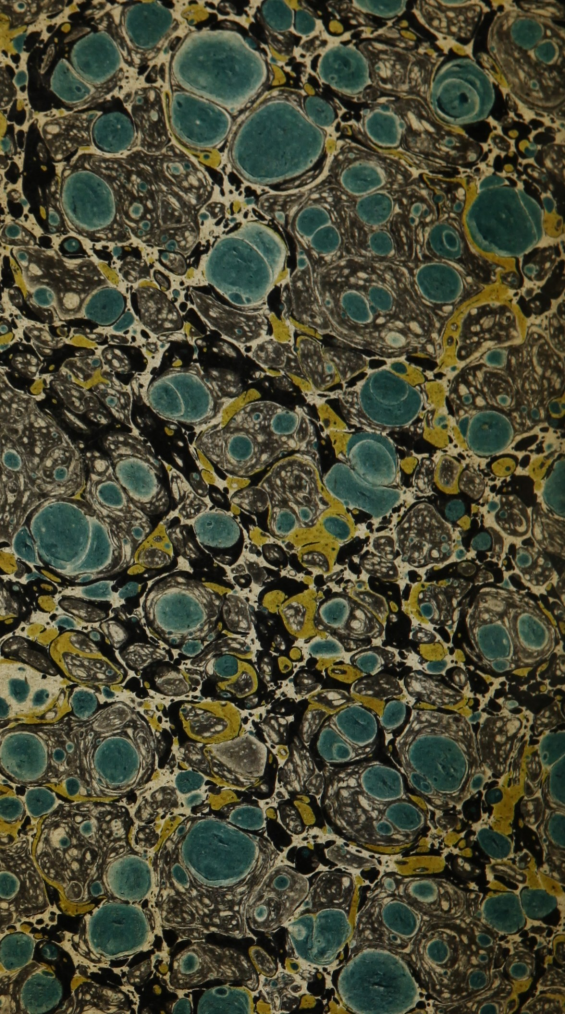
This method of conſidering contagions is entirely conformable to the ſimplicity of nature. The aſſignment of a multiplicity of cauſes, to account for particular phenomena, always betokens a backward ſtate of knowledge. The buſineſs of ſcience is to generalize facts, to claſs phenomena under diſtinct heads, and ſhow their dependance upon a common principle or cauſe. Accordingly, in the progreſs of human reaſon, polytheiſm has yielded to the conviction of the exiſtence of *one God;* the intricate and ſeemingly oppoſite phenomena of matter and motion have been referred to one general law of gravitation; the puzzling and diverſified appearances of electricity have been reduced to a few plain rules; the multitude of facts concerning light and colours have been in like manner arranged into a ſcientific form; and both the *rainbow* and the

teleſcope

teleſcope bear witneſs to the ſimplicity of optics. The fluids compoſing our atmoſphere have been analized, and the influence of theſe, and of many occaſional combinations of other ſubſtances into gaſes, upon life and health, been inveſtigated to their principles. Contagion alone has remained a ſubject for doubting and gueſſing; a diſmal ſomewhat, whoſe exact origin was unknown, and whoſe operation ſeemed capricious or unaccountable. This, I truſt, will now, like other agents in creation, be found to have its laws of production, diffuſion and action, which are ſteady and unvaried in their nature, as well as ſimple and eaſy to be comprehended.

I was going into the practical conſiderations and directions reſulting from the principles laid down; but the ſubject was ſo extenſive, and materials flowed in upon me ſo faſt, that the work would very ſpeedily have extended far beyond the bounds I had now preſcribed to myſelf; and impreſſed as I was with the extenſive and beneficial application of this doctrine of contagion to every place upon earth where it is generated, and to every conſtitution upon which it acts, I felt a deep concern to make it public as ſoon as I conveniently could.

FINIS.



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